



2016 Astrophysics Explorers Announcement of Opportunity (AO) Concept Study Report (CSR) Evaluation Plan

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(Changes in Bold Italics)



Signature Page Astrophysics Explorers

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Introduction

- The goal of NASA's Explorers Program is to provide frequent flight opportunities for high quality, high value, focused heliophysics and astrophysics science investigations that can be accomplished under a not-to-exceed cost cap and that can be developed relatively quickly, generally in 36 months or less, and executed on-orbit in less than 3 years.
- The purpose of this evaluation plan is to define the ground rules, processes, organizations, and schedules to be used in evaluating the Astrophysics Explorers Concept Study Reports (CSRs).
- Two Full Missions and two Missions of Opportunity were selected for concept studies, which constitute each investigation's Concept and Technology Development Phase (Phase A) of the Formulation process as outlined in NPR 7120.5E, NASA Spaceflight Program and Project Requirements. In addition, one Full Mission and one Mission of Opportunity were conditionally selected for concept studies.



Evaluation Plan Overview

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- The Explorers Announcement of Opportunity (AO), under which the investigations to be evaluated were selected, is comprised of two solicitations: AO NNH16ZDA010O, entitled Astrophysics Explorers Program 2016 Medium Explorer (MIDEX), issued September 15, 2016, and Program Element Appendix (PEA) R, entitled 2016 Astrophysics Explorers Mission of Opportunity, appended September 15, 2016, to the Second Stand Alone Mission of Opportunity Notice (SALMON-2) AO NNH12ZDA006O. The MIDEX AO was amended on November 14, 2016, and the Mission of Opportunity PEA-R was amended on October 21, 2016.
- The Science Office for Mission Assessments (SOMA) at NASA Langley Research Center (LaRC) developed this Explorers AO CSR Evaluation Plan for the Science Mission Directorate (SMD) at NASA Headquarters.
- This CSR Evaluation Plan has been cleared for public release by SMD.
- The Astrophysics Explorers Program Scientist is responsible for validating all evaluation processes, responsibility assignments, assumptions, and ground rules.



Background Astrophysics Explorers

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- 2 Full Missions were selected for Phase A concept studies.
 - Arcus: Exploring the Formation and Evolution of Clusters, Galaxies, and Stars – Randall Smith, PI, Smithsonian Astrophysical Observatory, Cambridge, MA – Arcus would study stars, galaxies and clusters of galaxies using high-resolution X-ray spectroscopy to characterize the interactions between these objects and the diffuse million-degrees gas that surrounds and permeates them.
 - SPHEREx: Spectro-Photometer for the History of the Universe, Epoch of Reionization, and Ices Explorer - James Bock, PI, California Institute of Technology, Pasadena, CA – SPHEREx would perform an all-sky near infrared spectral survey to probe the origin of our Universe; explore the origin and evolution of galaxies, and explore whether planets around other stars could harbor life.
- In addition, one Full Mission was conditionally selected for a Phase A Concept Study.
 - FINESSE: Fast INfrared Exoplanet Spectroscopy Survey Explorer – Mark Swain, PI, Jet Propulsion Laboratory, Pasadena, CA – The FINESSE mission would be dedicated to finding out what exoplanet atmospheres are made of, what conditions or processes are responsible for the composition, and how our own solar system fits into the larger family of planets.



Background (continued)

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- 2 Missions of Opportunity were selected for competitive Phase A concept studies. These 2 missions are Class D.
 - The Compton Spectrometer and Imager Explorer (COSI-X), a Small Complete Superpressure Balloon Mission - Steven Boggs, PI, University of California, Berkeley - COSI-X would be a balloon-borne Small Complete Mission that is designed to uncover the origin of Galactic positrons, reveal how nuclear processes shape our Galaxy, and gain insight into extreme environments with polarization measurements.
 - The Transient Astrophysics Observer on the ISS (ISS-TAO) - Jordan Camp, PI, NASA Goddard Space Flight Center - would be a Small Complete Mission consisting of a soft X-ray telescope with a wide field-of-view and a Gamma-Ray Transient Monitor, that would be installed on the International Space Station. The mission would search for electromagnetic counterparts of gravitational wave events, study transient high-energy events, and monitor the variability of high-energy sources.



Background (continued)

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One Partner Mission of Opportunity was conditionally selected for a non-competitive Phase A concept study.

- Contribution to ARIEL Spectroscopy of Exoplanets (CASE) – Mark Swain, PI, Jet Propulsion Laboratory, Pasadena, CA - CASE would provide packaged detectors to ARIEL's Fine Guidance Sensor assembly. ARIEL would measure the spectra of hundreds of warm and hot transiting gas giants, Neptunes, and super-Earths around a range of host star types. Observations of these exoplanets will allow us to understand the early stages of planetary and atmospheric formation during the nebular phase and the following few millions of years.

The selections of the FINESSE mission and the CASE mission of opportunity investigation proposals are conditional on the outcome of ESA's M4 competition. ESA has selected ARIEL as the ESA M4 mission. The continuation of the CASE investigation at KDP B is conditional on CASE satisfactorily addressing concerns identified in the proposal review process, on NASA accepting the CASE team's technical proposal, and on NASA negotiating appropriate data sharing policies with ESA.

The FINESSE MIDEX mission would address the same science objectives as ESA's ARIEL mission. Since ESA has selected ARIEL as the M4 mission, the selection of the FINESSE MIDEX investigation for a Phase A Concept Study has been cancelled, and the FINESSE investigation has been terminated.



Handling of Proprietary Data

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- All CSR related materials will be considered proprietary.
- Only those individuals with a need to know will be allowed to view CSR materials.
- Each non Civil Servant (CS) or non Intergovernmental Personnel Act (IPA) Assignee evaluator will sign a NASA Non-Disclosure Agreement (NDA) which must be on file with NASA Research and Education Support Services (NRESS) prior to any CSRs being distributed to that evaluator.
 - CS and IPA evaluators are not required to sign an NDA.
- All Report Materials in hardcopy format will be numbered and controlled, and a record will be kept of who has been supplied with what materials, both electronic and hardcopy.
- Evaluators and Observers will be briefed at a Kickoff telecon on how to handle the CSR material. Evaluators will be briefed that they are not allowed to discuss CSRs with anyone outside their own Evaluation Panels ever. Evaluators will be briefed to not contact anyone outside of their Evaluation Panel to gain insight on any CSR related matter without expressly getting authorization from the Astrophysics Explorers Program Scientist (Dr. Linda Sparke), or the Technical, Management, and Cost (TMC) Panel Chair (Odilyn Luck) in advance of making the contact.



Handling of Proprietary Data (continued)

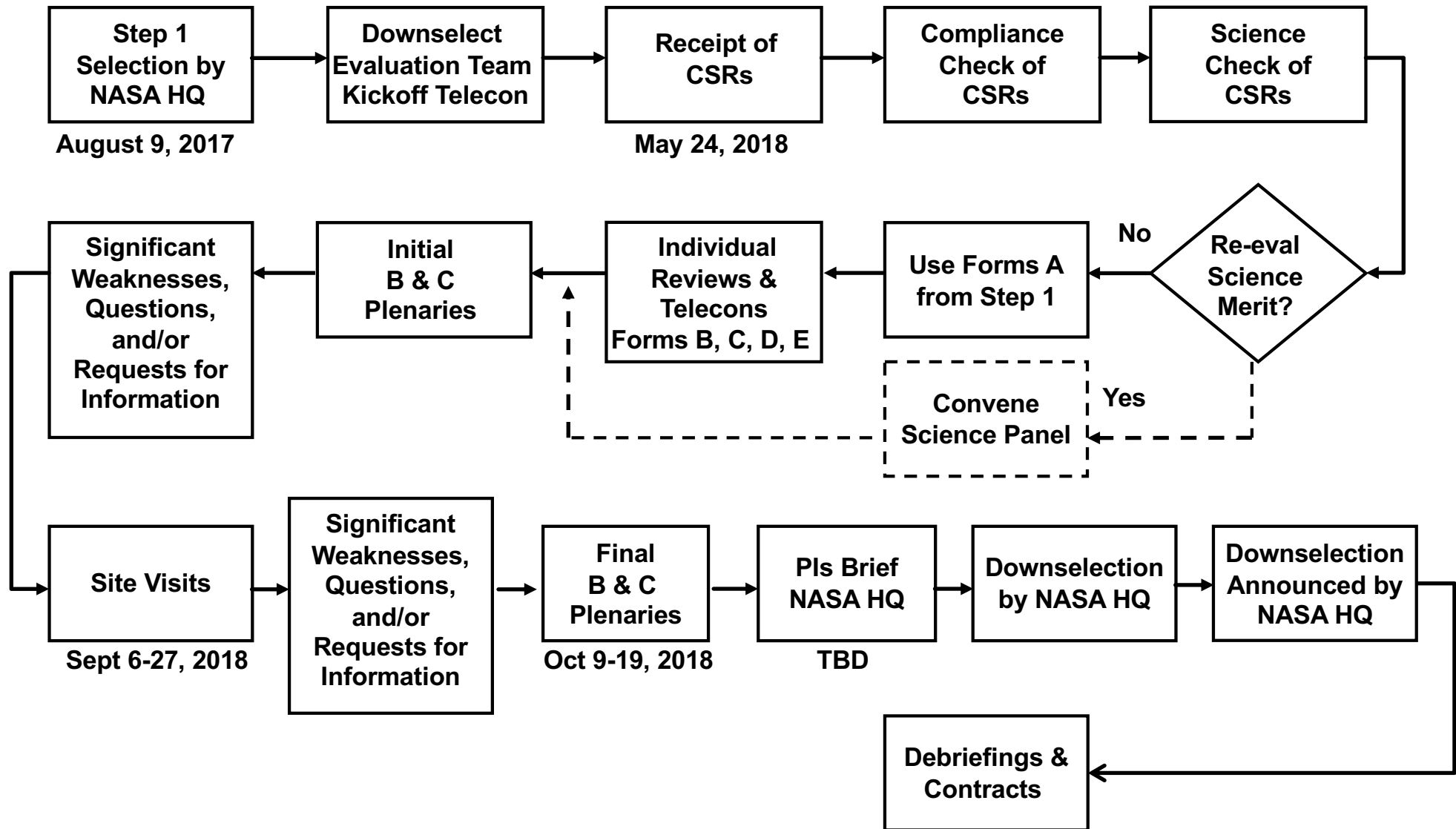
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- During the Evaluation, all proprietary information that needs to be exchanged between evaluators will be transferred securely via the secure Remote Evaluation System (RES) web site maintained by SOMA, via the secure ScienceWorks System maintained by SMD, via controlled WebEx, via NASA's Large File Transfer capability, or via encrypted email, parcel post, fax, or regular mail. Proprietary information will not be sent via unencrypted email.
- Telecon line information is confidential. The phone numbers and pass codes are posted in a file on the Remote Evaluation Site (RES). Participants will be briefed to ensure they do not provide this information to anyone or distribute this information via email.
- When the evaluation process is complete, CSR materials will be collected. Some copies (for archival purposes) will be maintained by the Program Scientist at NASA HQ, and in the NRESS and SOMA vaults. Also, some CSR material from the downselected mission(s) will be provided to the Explorers Program Office at GSFC. All other CSR materials will be destroyed.
- Evaluators' electronic and paper evaluation materials will be deleted/destroyed when the evaluation process is complete. Archival copies will be maintained in the NASA Science Office for Mission Assessments (SOMA) vault.



CSR Evaluation Flow Astrophysics Explorers

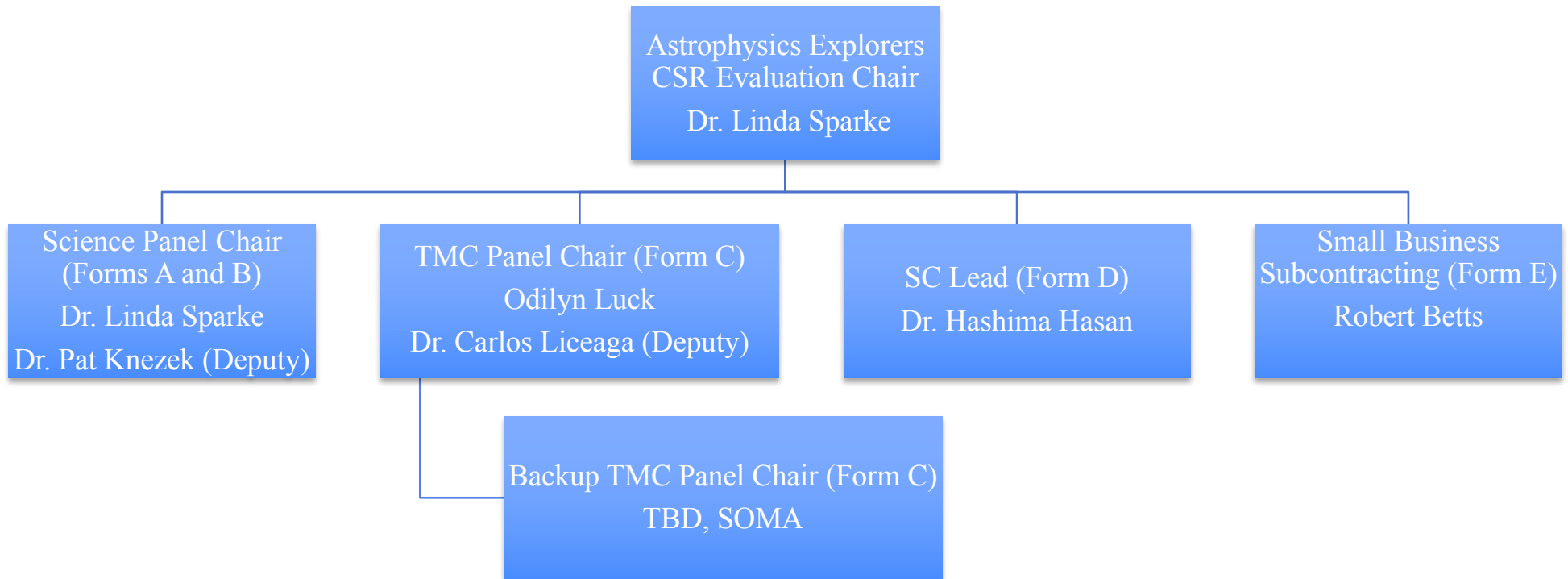
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Organization Astrophysics Explorers

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Plan to Avoid Conflict of Interest (COI)

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- Members of Evaluation Panels are cross checked against the draft list of organizations and individuals provided by the study teams to ensure no individual or organizational COI exists with the planned evaluators. Evaluators are required to raise any potential COIs.
- After the Concept Study Reports (CSRs) are received, all members of the Evaluation Panels will again be cross checked against the lists of personnel on each CSR and organizations mentioned in each CSR to ensure no individual or organizational COI exists on the list of evaluators.
- In addition, all evaluators will review the final list of conflicted organizations and be required to divulge whether they have any financial, professional, or personal potential conflict of interest and whether they work for a profit making company that directly competes with any profit making proposing organization.
- Any potential COI issue is discussed with the Astrophysics Program Scientist and the SMD Deputy Associate Administrator for Research, and documented in the Astrophysics Explorers Downselect COI Mitigation Plan.
- All Civil Service evaluators will self-certify their COI status by reviewing a combined listing of individuals and organizations associated with the CSRs. The TMC evaluators must notify the TMC Panel Chair, Odilyn Luck, in case there is a potential conflict. The Science evaluators must notify the Science Panel Chair, Dr. Linda Sparke, in case of a potential conflict.
- If any evaluators with potential organizational COI must be used, their respective organizations must submit a plan, as required by their contract or SMD waiver, addressing the Conflict of Interest and mitigation plan. This plan will outline how they will firewall the potentially conflicted evaluator(s) during the evaluation process from the conflicted part of their organization.



Plan to Avoid COI

- If during the evaluation there is any actual conflict of interest noted, the conflicted member(s) will be notified to stop reviewing CSRs immediately and the Astrophysics Explorers Program Scientist will be notified. Steps will be expeditiously taken to remove any actual or potential bias imposed by the conflicted member(s).
- Community standards for conflicts of interest will be applied to all evaluators as directed in SMD Policy Document SPD-01A. Standards for financial conflicts of interest as specified in 18 USC 208 will be applied to civil servant evaluators. The HQ Office of General Counsel will be consulted as necessary.



Evaluation Criteria and Additional Selection Factors

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- The Criteria to Evaluate the Concept Study Reports are documented in the 2016 ASTROPHYSICS EXPLORER GUIDELINES AND CRITERIA FOR THE PHASE A CONCEPT STUDY at:
<https://explorers.larc.nasa.gov/APMIDEX2016/MIDEX/programlibrary.html> &
<https://explorers.larc.nasa.gov/APMIDEX2016/MO/programlibrary.html>
- Evaluation criteria for Concept Study: approximate significance of each criterion is indicated by the percent weighting.
 - Form A: Scientific Merit of the Investigation (will not be reevaluated unless it is determined that the science has changed from that described in the Step 1 proposal) (approximately 25%)
 - Form B: Scientific Implementation Merit and Feasibility of the Investigation (approximately 20%)
 - Form C: Feasibility of Mission Implementation, Including Cost Risk (approximately 50%)
 - Forms D and E: Quality of plans for optional Student Collaboration (SC) if proposed, and small business subcontracting plans (approximately 5%)
- Additional selection factors
 - NASA budget changes and/or other programmatic factors, including but not limited to changes in scientific mandates, national priorities, and budgetary forecasts that were not evident when the AO or the PEA were issued. The PI-managed Mission Cost, as well as other programmatic factors, may be additional selection factors.



Evaluation Criterion A

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- **Scientific Merit of the Investigation** - The Astrophysics Explorers Program Scientist will determine whether any issues that may have emerged in the course of the concept study have effected significant changes to the science objectives or other aspects of the proposed Baseline and Threshold Science Missions (see Requirement CS-17 in Section II of the 2016 ASTROPHYSICS EXPLORER GUIDELINES AND CRITERIA FOR THE PHASE A CONCEPT STUDY) in such a manner as to have impacted the basis for the evaluation of the scientific merit of the investigation as determined by the peer review panel for the Step 1 proposal. If there are no significant changes to the proposed investigation that undermine the basis of this rating, the peer review panel rating for scientific merit of the Step 1 proposal will be the rating for scientific merit of the CSR. If there are significant changes, the Astrophysics Explorers Program Scientist will convene a peer review panel to reevaluate the scientific merit of the objectives in light of these changes. The factors for reevaluating this criterion will be the same as those used for the Step 1 proposal review (Section 7.2.2 of the AO or Section 7.2.2 of the SALMON-2 AO).



Evaluation Criterion B

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- **Scientific Implementation Merit and Feasibility of the Investigation** - All of the factors defined in Section 7.2.3 of the AO or Section 7.2.3 of the SALMON-2 AO apply to the evaluation of the CSR. Note that details have been added to one of the subfactors of Factor B-1, Merit of the instruments and mission design. Also, an additional subfactor has been added to Factor B-2, Probability of technical success.

[Updated June 13, 2018] For tailored Class D missions, the Factor B-5 is amended to delete evaluation of the PI experience with NASA missions. The panel may provide comments to the Selection Official on PI experience with NASA missions, and whether appropriate mentoring and support tools are in place. Any such comments will not contribute to the Science Implementation Merit and Feasibility of the Proposed Investigation grade.

- Factor B-1. Merit of the instruments and mission design for addressing the science goals and objectives. This factor includes the degree to which the proposed mission will address the goals and objectives; the appropriateness of the selected instruments and mission design for addressing the goals and objectives; the degree to which the proposed instruments and mission can provide the necessary data, *including details on data collection strategy and plans (n.b., items in italics added for the evaluation of the CSR);* and the sufficiency of the data gathered to complete the scientific investigation.



Evaluation Criterion B (continued)

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- Factor B-2. Probability of technical success. This factor includes the maturity and technical readiness of the instruments or demonstration of a clear path to achieve necessary maturity; the adequacy of the plan to develop the instruments within the proposed cost and schedule; the robustness of those plans, including recognition of risks and mitigation plans for retiring those risks; the likelihood of success in developing any new technology that represents an untested advance in the state of the art; the ability of the development team - both institutions and individuals - to successfully implement those plans; and the likelihood of success for both the development and the operation of the instruments within the mission design. *This factor includes assessment of technology readiness, heritage, environmental concerns, accommodation, and complexity of interfaces for the instrument design (n.b., subfactor in italics added for the evaluation of the CSR).*
- Factor B-3. Merit of the data analysis, data availability, and data archiving plan. This factor includes the merit of plans for data analysis and data archiving to meet the goals and objectives of the investigation; to result in the publication of science discoveries in the professional literature; and to preserve data and analysis of value to the science community. Considerations in this factor include assessment of planning and budget adequacy and evidence of plans for well- documented, high-level data products and software usable to the entire science community; assessment of adequate resources for physical interpretation of data; reporting scientific results in the professional literature (e.g., refereed journals); and assessment of the proposed plan for the timely release of the data to the public domain for enlarging its science impact.



Evaluation Criterion B (continued)

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- Factor B-4. Science resiliency. This factor includes both developmental and operational resiliency. Developmental resiliency includes the approach to descoping the Baseline Science Mission to the Threshold Science Mission in the event that development problems force reductions in scope. Operational resiliency includes the ability to withstand adverse circumstances, the capability to degrade gracefully, and the potential to recover from anomalies in flight.
- Factor B-5. Probability of science team success. This factor will be evaluated by assessing the experience, expertise, and organizational structure of the science team and the mission design in light of any proposed instruments. The role of each Co-Investigator (Co-I) will be evaluated for necessary contributions to the proposed investigation; the inclusion of Co-Is who do not have a well defined and appropriate role may be cause for downgrading of the CSR evaluation.
- Factor B-6. Merit of any Science Enhancement Options (SEOs), if proposed. This factor includes assessing the appropriateness of activities selected to enlarge the science impact of the mission; the potential of the selected activities to enlarge the science impact of the mission; and the appropriate costing of the selected activities. The peer review panel will inform NASA whether the evaluation of the proposed SEO(s) impacted the overall rating for scientific implementation merit and feasibility. Lack of an SEO will have no impact on the CSR's overall rating for scientific implementation merit and feasibility.



Evaluation Criterion B (continued)

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- Factor A-3 of the AO or the SALMON-2 AO will be re-evaluated as a factor for Scientific Implementation Merit and Feasibility; it has been renumbered as Factor B-7.
 - Factor B-7. Likelihood of scientific success. This factor includes how well the anticipated measurements support the goals and objectives; the adequacy of the anticipated data to complete the investigation and meet the goals and objectives; and the appropriateness of the mission requirements for guiding development and ensuring scientific success.



Evaluation Criterion B (continued)

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- A new evaluation factor that is not described in the AO or the SALMON-2 AO and was not evaluated for Step 1 proposals will also be included. This factor will be evaluated for the CSRs in addition to the factors specified in Section 7.2.3 of the AO, Section 7.2.3 of the SALMON-2 AO, or Section 6.1 of the PEA and updated above as Factors B-1 through B-7.
 - Factor B-8. Maturity of proposed Level 1 science requirements and Level 2 project requirements. This factor includes assessment of whether the Level 1 requirements are mature enough to guide the achievement the objectives of the Baseline Science Mission and the Threshold Science Mission, and whether the Level 2 requirements are consistent with the Level 1 requirements. The CSR will be evaluated for whether the requirements are stated in unambiguous, objective, quantifiable, and verifiable terms that do not conflict. The CSR will be evaluated for the adequacy, sufficiency, and completeness of the Level 1 and Level 2 requirements, including their utility for evaluating the capability of the instruments and other systems to achieve the mission objectives. The stability of the Level 1 science requirements and Level 2 project requirements will be assessed including whether the requirements are ready, upon initiation of phase B, to be placed under configuration control with little or no expected modifications for the lifecycle of the mission.



Evaluation Criterion C

TMC Feasibility of the Mission Implementation, including Cost Risk - All of the factors defined in Section 7.2.4 of the AO, Section 7.2.4 of the SALMON-2 AO, or Section 6.1 of the PEA apply to the evaluation of the CSR. All of these factors are interpreted as including an assessment as to whether technical, management, and cost feasibility are at least at a Phase A level of maturity.

For Class D missions, the Factor C-4 is amended to delete evaluation of Key Personnel. The TMC panel will provide comments to the selection official on Key Personnel qualifications and relevant experience, and whether appropriate mentoring and support tools are in place. These comments will not contribute to the TMC feasibility risk rating but will be considered by the selection official.

Note that the risk management aspects of Factor C-4, *Adequacy and robustness of the management approach and schedule, including the capability of the management team*, have been removed from Factor C-4 and included in a new evaluation factor, Factor C-6, *Adequacy of the risk management plan*.

- Factor C-1. Adequacy and robustness of the instrument implementation plan. The maturity and technical readiness of the instrument complement will be assessed, as will the ability of the instruments to meet mission requirements. This factor includes an assessment of the instrument design, accommodation, interface, heritage, and technology readiness. This factor includes an assessment of the instrument hardware and software designs, heritage, and margins. This factor includes an assessment of the proposer's understanding of the processes, products, and activities required to accomplish development and integration of the instrument complement. This factor also includes adequacy of the plans for instrument systems engineering and for dealing with environmental concerns. This factor includes an assessment of plans for the development and use of new instrument technology, plans for advanced engineering developments, and the adequacy of backup plans to mature systems within the proposed cost and schedule when technologies having a TRL less than 6 are proposed.



Evaluation Criterion C (continued)

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- Factor C-2. Adequacy and robustness of the mission design and plan for mission operations. This factor includes an assessment of the overall mission design and mission architecture, the spacecraft design and design margins (including margins for launch mass, delta-V, and propellant), the concept for mission operations (including communication, navigation/tracking/trajectory analysis, and ground systems and facilities), and the plans for launch services. This factor includes mission resiliency – the flexibility to recover from problems during both development and operations – including the technical resource reserves and margins, system and subsystem redundancy, and reductions and other changes that can be implemented without impact to the Baseline Science Mission. (*n.b.*, This factor will be applied only to the extent that it is appropriate for the MO proposals solicited by the PEA).
- Factor C-3. Adequacy and robustness of the flight systems. This factor includes an assessment of the flight hardware and software designs, heritage, and margins. This factor includes an assessment of the proposer's understanding of the processes, products, and activities required to accomplish development and integration of all elements (flight systems, ground and data systems, etc.). This factor includes an assessment of the adequacy of the plans for spacecraft systems engineering, qualification, verification, mission assurance, launch operations, and entry/descent/landing. This factor includes the plans for the development and use of new technology, plans for advanced engineering developments, and the adequacy of backup plans to ensure success of the mission when systems having a TRL less than 6 are proposed. The maturity and technical readiness of the spacecraft, subsystems, and operations systems will be assessed. The adequacy of the plan to mature systems within the proposed cost and schedule, the robustness of those plans, including recognition of risks and mitigation plans for retiring those risks, and the likelihood of success in developing any new technologies will be assessed. This factor will be applied only to the extent that it is appropriate for the proposals solicited by the applicable PEA.



Evaluation Criterion C (continued)

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- Factor C-4. Adequacy and robustness of the management approach and schedule, including the capability of the management team. This factor includes: the adequacy of the proposed organizational structure and WBS; the management approach including project level systems engineering; the roles, qualifications, and experience of the PI, PM, PSE, other named Key Management Team members, and implementing organization, mission management team, and known partners; the commitment, spaceflight experience, and relevant performance of the PI, PM, other named key management team members, and implementing organization, mission management team, and known partners against the needs of the investigation; the commitments of partners and contributors; and the team's understanding of the scope of work covering all elements of the mission, including contributions. This factor also includes assessment of CSR elements such as the relationship of the work to the project schedule, the project element interdependencies, the associated schedule margins, and an assessment of the likelihood of launching by the proposed launch date. *Also evaluated under this factor are the proposed project and schedule management tools to be used on the project along with the small business subcontracting plan including small disadvantaged businesses (n.b., subcontracting plan subfactor, in italics, added for the evaluation of the CSR).*

(Updated June 13, 2018) If tailoring of program and project management requirements is proposed, evaluators will comment on the CSR team's justification for that tailoring, but will not consider it a part of the risk rating.



Evaluation Criterion C (continued)

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- Factor C-5. Adequacy and robustness of the cost plan, including cost feasibility and cost risk. This factor includes elements such as cost, cost risk, cost realism, and cost completeness including assessment of the basis of estimate, the adequacy of the approach, the methods and rationale used to develop the estimated cost, the discussion of cost risks, the allocation of cost reserves by phase, and the team's understanding of the scope of work (covering all elements of the mission, including contributions). CSRs will be evaluated for the adequacy of the cost reserves and whether CSRs with inadequate cost reserves demonstrate a thorough understanding of the cost risks. This factor also includes an assessment of the proposed cost relative to estimates generated using parametric models and analogies. Also evaluated under this factor are the proposed cost management tools to be used on the project.



Evaluation Criterion C (continued)

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- The following evaluation factor has been removed as a subset of Factor C-4 described in the MDEX AO, the SALMON-2 AO, or the PEA, and has been revised for the evaluation of the CSR.
 - Factor C-6. Adequacy of the risk management plan. The adequacy of the proposed risk management approach will be assessed, as will any risk mitigation plans for new technologies, any long-lead items, and the adequacy and availability of any required manufacturing, test, or other facilities. The approach to any proposed descoping of mission capabilities will be assessed against the potential science impact to the proposed Baseline Science Mission. The plans for managing the risk of contributed critical goods and services will be assessed, including the plans for any international participation, the commitment of partners and contributors as documented in Letters of Commitment and the technical adequacy of contingency plans, where they exist, for coping with the failure of a proposed cooperative arrangement or contribution; when no mitigation is possible, this should be explicitly acknowledged. The stability and reliability of proposed partners, and the appropriateness of any proposed contribution, is not assessed as a management risk but will be assessed by SMD as a programmatic risk element of the investigation.



Evaluation Criterion C (continued)

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- The following are new evaluation factors that are not described in the AO or the PEA and were therefore not evaluated for Step 1 proposals. These will be evaluated for the CSRs in addition to the factors given in Section 7.2.4 of both the MDEX AO and the SALMON-2 AO, or Section 6.1 of the PEA and repeated or updated above as Factors C-1 through C-6.
 - Factor C-7. Ground Systems. This factor includes an assessment of the proposed mission operations plans, facilities, hardware and software, processes, and procedures.
 - Factor C-8. Approach and feasibility for completing Phase B. The completeness of Phase B plans and the adequacy of the Phase B approach will be assessed. This assessment will include evaluation of the activities/products, the organizations responsible for those activities/products, and the schedule to accomplish the activities/products.
- For the purpose of the CSR, investigation teams are not required to hold reserves against Government Furnished Equipment (GFE) such as the Launch Vehicle (LV). They should assume the Government will deliver as promised on factors such as LV performance and schedule. The Government is holding separate reserves on its promises.



Evaluation Criterion D (Student Collaborations)

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- **Quality and Merit of the Student Collaboration**
 - Overall Merit of Student Collaboration (SC), if proposed. This factor will include an assessment of whether the scope of the SC follows the guidelines in Section 5.5.3 of the AO or Section 5.7.2 of the SALMON-2 AO. The criteria to be used to evaluate the SC component and a discussion of those criteria are described in the document *Explanatory Guide to the NASA Science Mission Directorate Educational Merit Evaluation Factors for Student Collaboration Elements*, available in the Program Library.
 - For full missions proposed against the AO, there is no minimum and no maximum allowable cost for a SC. NASA is providing a student collaboration incentive that is defined to be 1% of the PI-Managed Mission Cost. The proposed cost of the SC, up to the student collaboration incentive, is considered outside of the PI-Managed Mission Cost. If the SC costs more than the student collaboration incentive, then the rest of the cost of the SC must be within the PI-Managed Mission Cost.



Evaluation Criterion E (Small Business Contracting Plans)

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- **Quality and Merit of Small Business Contracting Plans**
 - Merit of the Small Business Subcontracting Plans. This factor will be evaluated on the participation goals and quality and level of work performed by small business concerns overall, as well as that performed by the various categories of small business concerns listed in FAR 52.219-9, except for Small Disadvantaged Businesses (SDBs). Offerors will separately identify, and will be evaluated on, participation targets of SDBs in North American Industry Classification System (NAICS) codes determined by the Department of Commerce to be underrepresented industry sectors.



CSR Evaluation Panel Products

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- Form A if necessary
 - Grade range: Excellent, Excellent/Very Good, Very Good, Very Good/Good, Good, Good/Fair, Fair, Fair/Poor, or Poor
 - The Science Merit grade reflects the median grade
- Form B for all CSRs
 - Grade range: Excellent, Excellent/Very Good, Very Good, Very Good/Good, Good, Good/Fair, Fair, Fair/Poor, or Poor
 - The Science Implementation grade reflects the median grade
- Form C for all CSRs
 - Risk rating range:
 - Low Risk, Low/Medium Risk, Medium Risk, Medium/High Risk, or High Risk
 - The Risk Rating reflects the median grade
 - Student Collaboration separable from the main mission: Yes or No
- Form D (Student Collaboration) if proposed
 - Grades: Meritorious or Not Meritorious.
- Form E (Small Business Subcontracting Plans) for all CSRs
 - Grades: Acceptable or Needs Work



Grade Definitions - Forms A and B

- Form A and B Grade Definitions
 - Excellent: A comprehensive, thorough, and compelling CSR of exceptional merit that fully responds to the objectives of the AO as documented by numerous and/or significant strengths and having no major weaknesses.
 - Very Good: A fully competent CSR of very high merit that fully responds to the objectives of the AO, whose strengths fully outbalance any weaknesses.
 - Good: A competent CSR that represents a credible response to the AO, having neither significant strengths nor weaknesses and/or whose strengths and weaknesses essentially balance.
 - Fair: A CSR that provides a nominal response to the AO, but whose weaknesses outweigh any perceived strengths.
 - Poor: A seriously flawed CSR having one or more major weaknesses (e.g., an inadequate or flawed plan of research, or lack of focus on the objectives of the AO).
- Evaluators may also use grades in between these defined above



Definitions of Criterion A and B Findings

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Major Strength: A facet of the implementation response that is judged to be well above expectations and can substantially contribute to the Science Implementation Merit and Feasibility of the Investigation.

Minor Strength: A strength that substantiates the Science Implementation Merit and Feasibility of the Investigation.

Major Weakness: A deficiency or set of deficiencies taken together that are judged to substantially detract from the Science Implementation Merit and Feasibility of the Investigation.

Minor Weakness: A weakness that detracts from the Science Implementation Merit and Feasibility of the Investigation.

Note: Unlike Step 1, minor findings can influence ratings.



Risk Ratings Definitions - Form C

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The following definitions are indicators of risk. Evaluators must consider these definitions and input available for their consideration (e.g., cost model applicability, uncertainty of the cost models error bars and schedule analyses, uncertainty of the cost threats, mitigating factors such as major strengths, etc.) together with their judgement in determining the appropriate risk for a particular investigation.

Rating	Definition
Low Risk	Resources for technical, management, schedule, and cost are at or above the appropriate levels, with at least one resource significantly above, even after taking into account any problems that have been identified in the Phase A evaluation. No risks with unquantified cost threats* have been identified.
Low/Medium Risk	No problems have been identified in the Phase A evaluation that reduce the technical, management, schedule, and cost resources below the appropriate levels. Any identified risks with unquantified cost threats have a low probability of occurrence.
Medium Risk	Problems have been identified in the Phase A evaluation that reduce one of the resources slightly below the appropriate levels for: technical, management, schedule, or cost. Sound management and effective application of engineering resources will be required to solve the problems. Any identified risks with unquantified cost threats have a probability of occurrence that is not high.
Medium/High Risk	Problems have been identified in the Phase A evaluation that reduce one or more of the resources below the appropriate levels for: technical, management, schedule, and/or cost. The problems identified may not be solvable within the resources proposed, even with the use of sound management and effective application of engineering resources.
High Risk	Problems have been identified in the Phase A evaluation that reduce one or more of the resources significantly below the appropriate levels for: technical, management, schedule, and/or cost. The problems identified are deemed unsolvable within the resources proposed.

***Risks with unquantified cost threats** are defined in the grades above as those major weaknesses whose cost to fix cannot be quantified, but is large. The impacts of these risks are significant because they could lead to not achieving the baseline mission with the resources available.



Criterion C Panel Evaluation Principles for Astrophysics Explorers AO Downselect

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- Basic Assumptions for Step 1: Proposing team is the expert on their proposal.
 - Proposing team: Task is to provide evidence that the project is Low Risk.
 - Criterion C Panel: Task is to try to validate proposing team's assertion of Low Risk.
 - Proposing team given the benefit of the doubt.
- CSR Risk Assessment:
 - The tasks are the same as for Step 1, but expectations are higher.
 - The study team's task is to provide evidence that the project is Low Risk.
 - The Criterion C Panel's task is to try to validate study team's assertion of Low Risk.
 - The study team is not given the benefit of the doubt in the downselect.
- All CSRs will be reviewed to identical standards.
 - All CSRs receive same evaluation treatment in all areas.
- The Criterion C Panel is made up of evaluators who are experts in the areas of the CSRs that they evaluate.
- The Criterion C Panel develops findings for each CSR that are based on individual comments and reflect the general agreement of the entire panel.
 - Findings: Comments that are as expected are not included as findings. Comments that are above expectations result in strengths, and those that are below expectations result in weaknesses.



Definitions of Criterion C Findings

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Major Strength: A facet of the response that is judged to be well above expectations and can substantially contribute to the ability to meet technical commitments on schedule and within cost.

Major Weakness: A deficiency or set of deficiencies taken together that are judged to substantially affect the ability to meet the proposed technical objectives within the proposed cost and schedule.

Minor Strength: A strength that is substantial enough to be worthy of note and brought to the attention of study team in debriefings.

Minor Weakness: A weakness that is substantial enough to be worthy of note and brought to the attention of study team in debriefings.

Note: Unlike Step 1, minor findings can influence risk ratings.



Cost Evaluation

- All information from the entire evaluation process will be considered in the final cost assessment.
- The proposed cost for Phases A-D will be assessed using estimates generated by three independent cost models.
- The proposed cost for Phase E of Full Missions will be assessed using estimates from at least one cost model.
- The evaluation will assess the cost risk, cost realism, and cost completeness, including the basis of estimate, the adequacy of the approach, the methods and rationale used to develop the estimated cost, the discussion of cost risks, the allocation of cost reserves by phase, and the team's understanding of the scope of work.
- The likelihood and cost impact of significant weaknesses and cost analysis findings will be assessed.
- Cost threat impacts to the proposed unencumbered reserves will be assessed (see Cost Threat Matrix slides 36 and 37).
- The adequacy of the remaining unencumbered reserves will be assessed.
- Draft Forms C and Cost Evaluation Summaries (CESs) will be completed on all CSRs prior to the Initial Form C Plenary.
- During the Form C Plenaries, the entire panel will participate in Cost deliberations
- All significant Cost Findings will be included on the Form C and considered in the TMC Risk Rating.



Full Mission (MIDEX) Cost Threat Matrix

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- The *likelihood* and *cost impact*, if any, of each weakness is stated as “This finding represents a cost threat assessed to have an Unlikely/Possible/Likely/Very Likely/Almost Certain likelihood of a Very Minimal/Minimal/Limited/Moderate/Significant/Very Significant cost impact being realized during development and/or operations, which results in a reduction from the proposed unencumbered reserves.”
- The *likelihood* is the probability range that the *cost impact* will materialize.
- The *cost impact* is the current best estimate of the range of costs to mitigate the realized threat.
- The cost threat matrix below defines the adjectives used to describe the *likelihood* and *cost impact*.
- The minimum cost threat threshold for Phase E is set at \$1M.

		Cost Impact (CI)					
		% of PI-Managed Mission Cost to complete Phases A/B/C/D or % of Phase E not including unencumbered cost reserves or contributions					
		Very Minimal 0.5% < CI ≤ 2.5% 1% < CI ≤ 2.5%	Minimal 2.5% < CI ≤ 5% 2.5% < CI ≤ 5%	Limited 5% < CI ≤ 10% 5% < CI ≤ 10%	Moderate 10% < CI ≤ 15% 10% < CI ≤ 15%	Significant 15% < CI ≤ 20% 15% < CI ≤ 20%	Very Significant CI > 20% CI > 20%
Likelihood (L, %)	Almost Certain (L > 80%)						
	Very Likely (60% < L ≤ 80%)						
	Likely (40% < L ≤ 60%)						
	Possible (20% < L ≤ 40%)						
	Unlikely (L ≤ 20%)						

Note: For each proposal the percentages in the above table will be converted to dollars by the cost estimator.



Missions of Opportunity (MO) Cost Threat Matrix

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Evaluation Plan

- The *likelihood* and *cost impact*, if any, of each weakness is stated as “This finding represents a cost threat assessed to have an Unlikely/Possible/Likely/Very Likely/Almost Certain likelihood of a Minimal/Limited/Moderate/Significant/Very Significant cost impact being realized during development and/or operations, which results in a reduction from the proposed unencumbered reserves.”
- The *likelihood* is the probability range that the *cost impact* will materialize.
- The *cost impact* is the current best estimate of the range of costs to mitigate the realized threat.
- The cost threat matrix below defines the adjectives used to describe the *likelihood* and *cost impact*.

		Cost Impact (CI, % of PI-Managed Investigation cost to complete Phases A/B/C/D or E not including unencumbered cost reserves)				
		Minimal (2.5% < CI ≤ 5%)	Limited (5% < CI ≤ 10%)	Moderate (10% < CI ≤ 15%)	Significant (15% < CI ≤ 20%)	Very Significant (CI > 20%)
Likelihood (L, %)	Almost Certain (L > 80%)					
	Very Likely (60% < L ≤ 80%)					
	Likely (40% < L ≤ 60%)					
	Possible (20% < L ≤ 40%)					
	Unlikely (L ≤ 20%)					

Note: For each proposal the percentages in the above table will be converted to dollars by the cost estimator.



Grade Definitions – Form D

Student Collaboration (SC)

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- The merit of any Student Collaboration (SC) will be given one of two adjectives: Meritorious or Not Meritorious
 - **Meritorious:** The student collaboration proposed has achievable education goals and objectives and an implementation/oversight/management approach that will provide students with a rich hands-on education experience.
 - **Not Meritorious:** The student collaboration proposed has not articulated achievable education goals and objectives and/or the implementation/oversight/management approach limits the likelihood of success for student's opportunities for hands-on experience.



Grade Definitions – Form E

Small Business Subcontracting

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- The merit of the Small Business Subcontracting Plans will be rated as either Acceptable or Needs Work
 - **Acceptable:** The subcontracting plan adequately addresses all required elements of a subcontracting plan, and the proposed subcontracting percentage goals and the quality level of the work to be performed by small business concerns is sufficient.
 - **Needs Work:** The subcontracting plan does not address all required elements of a subcontracting plan, or the proposed subcontracting percentage goals and quality of work to be performed by small businesses is not sufficient, and further participation must be negotiated if this mission is selected.



Criteria B & C Panel Processes

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- Evaluation panel members review assigned CSRs and perform an individual review before discussing findings with other members of the panel.
- The SOMA Remote Evaluation System (RES) will be used for:
 - Entering individual evaluation panel member's comments for Criterion B and Criterion C.
 - Developing draft and final Forms B and Forms C for each CSR.
 - A repository for all final Forms for the evaluation (Forms B, C, D, and E).
- Only Form C evaluators that have participated in the Form C Initial Plenary and the Form C Final Plenary may participate in polling on Form C. Note that several Form B evaluators will also be designated as Form C evaluators by the Astrophysics Program Scientist.
 - Participation is defined as in person or via telecon.
 - Specialist Evaluators* are not polled.
- Only Form B Evaluators that have participated in the Initial Plenary and the Final Plenary may participate in polling on Form B. Note that several Form C evaluators will also be designated as Form B evaluators by the Astrophysics Program Scientist.
 - Participation is defined as in person or via telecon.

* Specialist Evaluators (to provide special technical expertise to Criterion B/C/D/E Panels) and External/Mail-In Evaluators (to provide special science expertise to the Criterion B Panel) may be utilized, respectively, based on the specific technology and science that is proposed.



Panel Processes (continued)

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- Consistency Review for Form C findings and Form B findings.
 - Form C consistency
 - A Form C Consistency Group will review all Form Cs and questions at the Initial Plenary and all Form Cs at the Final Plenary.
 - Form C Evaluators will review all CSRs for Full Missions, Missions of Opportunity, or both. Specialist Evaluators may review a subset of CSRs for Full Missions, Missions of Opportunity, or both.
 - Form B consistency
 - Form B Consistency Checker(s) will review all Form Bs and questions at the Initial Plenary and all Form Bs at the Final Plenary.
 - Form B and Form C consistency
 - At least one Form B Evaluator for each CSR will participate in the Form C discussions for each mission at the plenary meetings
 - Some Form C Instrument experts will participate in Form B discussions.
 - Consistency of findings between Form B and C will be reviewed at the Initial and Final Plenaries and adjudicated.



Initial Plenary

- The Initial Plenary is used to identify significant issues related to Criterion B and C based on the initial evaluation of the CSR. Initial Form Bs and Cs are reviewed.
- The Goal of the Initial Plenary is:
 1. Identify the Major Weakness, Minor Weaknesses, Major Strengths and Minor Strengths of each CSR.
 2. If necessary, develop questions and/or requests for information in addition to the Significant Weaknesses to give each study team an opportunity to clarify any misunderstanding.
- The main topic areas are the implementation issues in Criterion B and Criterion C.
- No polling on grades occurs at the Initial Plenary (Criterion B and Criterion C)
- The Significant Weaknesses (SWs), questions, and/or requests for information will be sent to each study team 7 days prior to its Site Visit.
- Criterion D (Student Collaboration) and Criterion E (Small Business Subcontracting) are reviewed as required by Criterion specific panels prior to the Initial Plenary. Site Visit questions are prepared and provided no later than the Initial Plenary to the Astrophysics Explorers Program Scientist.



Significant Weaknesses, Questions, and RFIs List (SQRL)

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- Significant Weaknesses (SWs), Questions, and Requests for Information (RFIs) for the Study Team
 - All SQRLs will be sent to the study team in advance of the Site Visit.
 - The SWs are preliminary and may change based on Site Visit information and further discussion by evaluation panels.
 - Questions may also be sent to the study team or verbalized during the Site Visit.
 - Questions must be of significance to a Form A, B, C, D, or E rating.
- The Astrophysics Explorers Program Scientist will approve all SQRLs developed at the Initial Plenary. Three types of responses are planned for SQRLs. These types may be combined for a given SW, question, or RFI.
 - Written response prior to Site Visit: SQRLs provided to the Study team that must be addressed in writing prior to the Site Visit. The nature of some SQRLs require data that must be reviewed prior to the Site Visit.
 - Written response at Site Visit: SQRLs that require documentation, but not extensive review.
 - Site Visit presentation: SQRLs that must be addressed the day of the Site Visit by way of presentation.
- The evaluation team members may ask questions during the Site Visit to ensure they understand the response to a SQRL, or to clarify any significant issues.



Site Visits

- Site Visits with Oral Briefings will be used to clarify implementation details and commitments. The study team may address weaknesses identified in the concept study and provide updates on the concept study since submission of the Concept Study Report.
- Site Visit locations and dates are negotiated with the PI
- Briefings at each Site Visit will be limited to 7 hours with 1 additional hour for a site tour, 15 minutes for SC if necessary, 1 hour for lunch, and 15 minute breaks in the morning and afternoon. Suggest a schedule of 8:30 a.m. – 6:00 p.m (6:15 p.m., if SC is submitted).
- All Site Visit presentations/briefings should be in a plenary session with all Evaluation Team members attending - no splinter sessions – unless authorized by the Astrophysics Explorers Program Scientist or TMC Panel Chair.
- Written Significant Weaknesses, questions, and/or requests for information will be submitted to the PI 7 days before the Site Visit. All teams will have the same lead time.
- All information relevant to the evaluation, including information presented during the Site Visit; information provided in response to Significant Weaknesses, questions, and/or requests; and information contained in the CSR will be considered during the evaluation.
- Additional Significant Weaknesses, Questions, and/or Requests for Information:
 - NASA may send additional Significant Weaknesses, questions, and/or requests for information to study teams the day after their respective Site Visits and/or during a specific timeframe (October 11-19, 2018), if necessary, to resolve any issue or clear up potential misunderstandings. Responses will typically be due within 4 days for post-Site Visit SQRLs and 24 hours for the October SQRLs.



Final Plenary Products

- Finalize all evaluation Forms based on the information in the CSRs and clarifications.
- Both Major and Minor Strengths and Weakness will be considered in the Grade for all Forms.
 - Form B
 - Polling will be held twice on the Form B grade. The final polling is recorded and reported. For the final polling, the individual grades are recorded and the median grade is calculated and recorded as the final polling. A median score that falls between two grades will be “rounded” in the direction of the mean score; if mean and median are equal, the score will be “rounded” towards the less favorable grade.
 - If there is a divergence of opinion, there may be additional rounds of discussion and polling.
 - SWs, questions, and/or requests for information generated during the Final Plenary may result in additional rounds at or after the Final Plenary.
 - Form C
 - Form C will be reviewed three times. Polling will be held twice on the Form C risk rating. The final polling is recorded and reported. For the final polling, the individual grades are recorded, the median calculated and the final grade recorded which reflects the Form C Risk rating of the median of the polling. A median score that falls between two risk ratings will be “rounded” to the higher risk rating.
 - If there is a divergence of opinion, there may be additional rounds of discussion and polling.
 - SWs, questions, and/or requests for information generated during the Final Plenary may result in additional rounds at or after the Final Plenary.
 - Form D Student Collaboration (if necessary)
 - Representatives from the SC Panel will consider the Merit of any proposed Student Collaboration.
 - Form E Small Business Subcontracting
 - LaRC Small Business Office will evaluate this factor



Observers and Transition Briefing

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- The SMD Deputy Associate Administrator for Research may invite Civil Servants, Intergovernmental Personnel Act Assignees, and Contractors with downstream implementation responsibilities to participate as observers to panel meetings and Site Visits.
 - Observers must comply with SMD Policy Document SPD-17, *Statement of Policy on Observers at Panel Reviews of Proposals*. This policy will be provided to all approved observers.
- Invited Observers will include:
 - Astrophysics Explorers Program Executive: Mark Sistilli
 - Explorers Mission Program Office: Nick Chrissotimos, Greg Frazier, and Christine Hinkle are invited due to their positions in the Program Office, which will oversee implementation of the selected mission(s). Their participation as Observers will provide early knowledge to the Program Office of any potential implementation challenges for the downselected mission(s).
 - ***HQ Program Scientist: Eric Tollestrup was invited to the CASE Site Visit and Final TMC Plenary. If NASA proceeds with CASE, Dr. Tollestrup would be the CASE Program Scientist. [added on September 27, 2018]***
- After selection is announced, a Transition Briefing will be provided by the Evaluation Team to Civil Servants and Intergovernmental Personnel Act Assignees in the Explorers Program Office and at Headquarters who have implementation responsibilities.